each end. The inner eyes are connected by a tie of wire or wire rope 193, to reinforce the hose. The tubes are firmly fastened to the plugs by wire wrappings 194. The tubes are retained to the wheels by ties 195 tensioned by a turn buckle 196 and passing around studs 197 bolted to the wheel as at 198. A valved nipple 199 is provided for inflating the tubes. A plurality of these tread members is provided for each of the front wheels at least, and advantageously for all wheels. The tread tubes are conveniently inflated to about 40 pounds pressure.

Because of the large size of the tires, the vehicle is cushioned sufficiently so that springs are unnecessary.

In operation, the vehicle is driven on land in a manner generally similar to the operation of ordinary trucks and automobiles. It is capable of high road speeds. For operation in water, the treads are put on and the vehicle is capable of substantial speeds though generally not as high as land speeds. The vehicle sinks in water about half way to the hubs, the water level being about as indicated at 200 in Fig. 1. We have discovered that this degree of buoyancy is best; it enables the difficult operation of coming out from water to land to be performed with ease. Fig. 14 shows this situation. As the front end of the vehicle rises, weight is drawn off the front end and towards the rear end and this effect is accentuated because the rear end tends to sink. Nevertheless, the vehicle can climb. With buoyancy relations much different from those indicated, this maneuver would be impossible. The rear end might sink so far and tip the front end up so much that no traction could be secured on the land.

The vehicle is so constructed that when loaded the center of gravity is symmetrical with respect to the wheels. That is, the center of gravity is about midway between the wheels fore and aft and sideways, and is not much above the plane of the wheels. We have discovered that this makes for a very seaworthy vehicle, whereas neglect of these considerations may result in an utterly inoperative machine.

In marshes, the vehicle sinks in to a depth depending upon the softness of the terrain, to a maximum of one-quarter the wheel diameter in the case of plain water. By virtue of the large diameter of the wheels and their close spacing fore and aft, and the swinging front axle, the vehicle can surmount logs, traverse ditches and generally go over ground which is impossible to travel by any other vehicle whatever, land or water, known to us, and quite inaccessible to men on foot. An important feature is that in traveling marshy country, no changeover procedure of any kind is necessary in going from water to land or vice versa. Even the speed of the vehicle is not substantially affected by the change in footing.

The vehicle, it will be noted, is designed for lightness throughout. Advantageously the various parts where possible are made of light alloys such as duralumin.

In open water, steering is effected by the front wheels as on land, differential braking being employed as described to facilitate this maneuver. Waves even of considerable height do not upset the vehicle. All the vital parts are well above the surface and do not tend to get splashed.

In getting out from water to land, when the banks are very steep, the best procedure is to get a good running start in the water and hit the land at high speed. Because of the largeness and softness of the tires no shock results even when the banks are steep. Ordinarily however the vehicle can climb out on land at low speeds. The vehicle described has found substantial use in actual operations in marshes and swamps.

What we claim is:

1. In an amphibian vehicle adapted to traverse the soft mud and water of marshes and force its way through the rank vegetation thereof, the combination of a frame, four buoyant wheels each having a buoyant, resilient pneumatic tire at least ten feet in diameter, means for mounting the wheels on the frame fore and aft substantially symmetrically with respect to the center of gravity of the vehicle and constructed and arranged to permit twisting of the axis of the front wheels with respect to that of the rear wheels so as to compensate for inequalities of the ground, said wheels being of such buoyancy as to support the weight of the vehicle while submerged approximately half way to the hubs, and the peripheries of the aft wheels being closely spaced from the peripheries of the fore wheels so as to facilitate passage from land to water, power means for driving all wheels and means for steering at least the fore wheels.

2. A vehicle for traversing marshes and open water comprising a frame, a pair of buoyant wheels mounted near the rear end of the frame, and a pair of buoyant wheels flexibly mounted near the front end of the frame so that the axis joining their center is capable of twisting in a vertical plane with respect to the axis joining the centers of the rear wheels, and means for driving all said wheels and for steering the front wheels.

3. A vehicle for traversing marshes and open water comprising a frame, a pair of buoyant wheels mounted near the rear end of the frame, a dead axle pivotally attached at its center to the frame adjacent the front end thereof, means for restraining rocking movement of the dead axle to a vertical plane, a pair of buoyant wheels mounted on the dead axle, means for driving all said wheels and means for steering the front wheels.

4. In a vehicle for traversing marshes and swamps, a frame, four wheels with large hollow buoyant resilient pneumatic rubber tires thereon of such size as to float the vehicle, resilient outwardly projecting means on the peripheries of the tires adapted to afford traction, a rear axle secured to the frame and arranged to carry two of said wheels, a dead front axle flexibly secured to the frame so as to permit twisting movement between the two axles in traversing uneven ground, stub axles pivotally secured to the dead axle and arranged to carry the other two wheels, an engine mounted on the frame, clutch and transmission means connecting the engine and all four wheels, means for swinging said stub axles whereby to steer the vehicle, and hand and foot operated brake means for at least two of the wheels.

5. A vehicle for traversing marshes, dry land and open water, comprising a frame, a pair of buoyant wheels mounted near the rear end of the frame, and a pair of buoyant wheels mounted near the front end of the frame, the wheels being arranged substantially symmetrically with respect to the center of gravity of the vehicle, means for supplying sufficient torque to at least two of said wheels to propel the said vehicle, and means for steering the vehicle, each of said wheels com-